

Recently, I was accused of cheating during a few of my Minecraft Speedrun live streams. This accusation comes with some mathematical backing, and that's what makes the accusation more serious than a willy nilly random one.

A curious viewer who noticed that my pearl luck seemed to be crazy high, decided to go through and count my pearl barbers along with how many barbers I did. This user posted the stats on twitter, pointing out how crazy it was, but without any accusations of cheating at the time. Some users in the speedrun discord, then reasonably decided to calculate the odds of such luck occurring. The initial calculations were around 1 in 1 billion. Obviously this is a statistically significant number, and the mods and others started to look into it.

Now, due to the fact that I am not a statistics major and I am by no means an expert at mathematics, this makes it a little harder for me to defend myself. From my standpoint, I didn't cheat, and there must be an explanation for why either the data is incorrect, or the situation happened in the first place.

Now again, because of the fact that I'm not amazing at statistics, more of this will be related to the non-statistics side of things than the statistics side of things. Although, I will go over both. Sections will be split with large titles. I'm going to start with the non statistics side of things, and end with the statistics.

## The Why

*The why* is a question that I'm sure is usually much easier to answer than any of the other questions, but in this case it isn't. I'm a popular Youtuber, who actually gets less views by streaming and uploading speedruns. On my Youtube, I get 9,766,666 views on average on my speedrun videos, and I get 21,528,571 average views on my non-speedrun videos in a similar time frame. This is less than half as many views on average. On my speed running streams, I get around 60,000 to 80,000 live concurrent viewers. On normal streams, I get around 130,000 live concurrent viewers. Again, much less.

The reason this matters at all, is to show that the normal motive of "Get a world record and millions of views from it", goes completely away with me. On top of that, it was many days after my last stream that this started getting looked into. I had already said I wasn't uploading my PB on either of my channels, and I didn't upload it on either.

As for 1.16 runs, I stated on many occasions that I was going for a sub 25 time, and that as soon as I got one I would stop. I really wanted to get to speedrunning 1.15, because that's the category that I feel most comfortable in. I had mentioned to a speedrun moderator my plans before, as well as many times on stream. I got a 25:06 during the streams, but I just wanted to get just below 25 minutes, even if it was 24:59. So the question is, *why* would I cheat? Obviously there's many answers to that, whether it be ego or convenience or whatever else, but most of those can be disputed fairly easily.

The biggest thing that I think should make “the why” suspicious is what happened AFTER the 1.16 runs. After I ran 1.16, I hopped off and one of the very next days I ran 1.15. Now this doesn’t seem significant, except for the fact that I had a run where I entered the stronghold at 17:45. The current record at the time being 21:26. Meaning I had over 3:30 to beat the game to get world record, and longer just to get a top 5 time. I was just short on pearls due to ender men spawning, and wasn’t able to get world record.

However, in an alternate universe where I get a few endermen spawns on the way to the stronghold during the night, which is actually the *more likely* scenario, I end up in the end around 18:30, with a pretty damn good chance at getting world record (I had the beds to one cycle). The interesting thing isn’t that I got this time, it’s that I got this time on a non modded client, and I got this time with generally average RNG, on a verifiable seed that can’t be cheated. If this run wasn’t cheated, obviously that would probably imply that my other (3) 1.15 world records weren’t cheated either. This is something that seems fairly accepted amongst the mod team and speedrun discord, especially because my initial world record was on a very unoptimized category where I chopped wood for 7 minutes.

So then that poses again the question, *why*. Why when I know that I am fully capable of taking a world record legit, on stream, on a different version that I care about, would I decide to randomly cheat in a very specific way on a version that I have clarified I don’t really care about on many occasions. Why would I risk my entire reputation just to get a *sub 25 time* on a version I don’t care about, and then *not cheat* to get *world record* on a version I main.

Now, that makes total sense, but only if you believe that I didn’t cheat previously. So then the question I have for you if you believe that I cheated my offline 1.15 runs, is again, why would I do this then? In your eyes, I was able to get away with faking 3 world records, offline, with very little questions asked and no accusations. If that was the case, why would I stream myself cheating for no reason? I’ve expressed on many occasions in private and public my disdain for streaming speedruns, and that I prefer to run offline by a large margin. I had also gotten explicit permission to run offline from Willz, and based on the speedrun rules it was perfectly fine. I also ran 1.15 online and had near identical results to my offline runs that were published.

If I was cheating for “clout” or any benefit, why would I not just splice a 1.16 world record offline and look like a god? Or why would I not just do the exact same thing for 1.15. Why would I settle for live streaming for a **sub 25** time, and then moving on to running a category for WR that doesn’t even have the same system I supposedly cheated (bartering). To me, that doesn’t make any sense whatsoever, and I feel like to most reasonable people it wouldn’t either.

Now continuing on with “the why”, let’s talk about further motive. I care about speedrunning a lot as a whole, and I think that’s something that’s very easily provable through my public and private actions. I’ve helped grow the community and the major members of it, while always trying to make sure that speedrunning has integrity. I’ve helped the mod team on multiple occasions try to and succeed at catching splicers and cheaters.

I've always been extremely open with the mod team, and I've even ran speedrunning events before in the past where I let the speedrun discord participate. I've always been open and honest about my thoughts on policy, my thoughts on different versions, and with when and how much I actually speedrun.

I believe that it would take an idiot to decide to cheat after growing their reputation in the way that I have, and with the capability that I have. Now it's fine for you to assume that I am an idiot, but when looking at all the evidence it's just hard to come up with "the why". This is a scary argument, but if I really was cheating, I could have submitted offline runs in both major categories that were world records and walked away with no way whatsoever to prove that I cheated. I'm not a random that would be defaulted as a cheater, I'm a trusted runner and if I provided sufficient "proof" to the mods, those offline world records would be verified.

There's many many smarter ways that I could have cheated if I was cheating, especially if I was supposedly going through the effort of creating a mod or modifying the game code. This doesn't clear anything, but it just again, amplifies the question of *why*?

That's it for this section, and again, this part isn't about the statistics, this is just completely calling into question the motive.

## The How

The how is a question of *how* someone could have cheated in this situation, and why different methods may or may not be unlikely. The first thing to mention during this section is a data pack. This seems to be the most common accusation, especially in the comments on the video regarding it, and also by quite a few people in the discord and other places. After my 1.16 PB of 19 minutes, I zipped up the world file directly after, and uploaded it to google drive within 5 minutes. With this information, the mods were able to verify that I did not use a data pack, or at least that it is extremely unlikely that I did. They can verify time stamps and see when certain folders and places were edited, as well as verify the timing of the world, and the fact that it wasn't edited. This cancels out data packs as a possible solution based on the evidence.

Another way that was mentioned, is to just directly modify game files. Although, according to multiple people with knowledge of the game, it is not possible without an actual mod or mod loader, or modifying the actual game code. This means that it cannot have just been opening a text file and changing "piglinbarbers.txt" or whatever people have implied.

This leaves the 3rd and final option, which is a modded client or just a mod through a mod loader. I used fabric while on 1.16, because that is what almost every speedrunner uses now. It allows you to use sodium, and other performance enhancing mods that are approved by

speedrun.com. Sodium boosts my performance and allows me to use higher render distances, which I've mentioned in the discord before, and is just obvious.

This would make the most likely scenario a mod that is in your mods folder, that uses the fabric loader. Now there is no way possible for me to specifically prove that this wasn't the case, however again I can continue to talk about the *how*. In order to do this, you would have to have coding knowledge when it comes to coding mods especially fabric ones. Now, the reason most people assume this makes me suspicious is because I'm a developer. However, I've never coded a mod in my life still to this day. I have coded many plugins, but I don't even know where to get started with a mod.

There is plenty of evidence to back this up as well. I run a patreon where I release all the mods and plugins that George and I use in our videos. Again, *mods* and plugins. Now I've probably released around 30 plugins, and 2 (shortly going to be 3), mods. The mods are coded using Fabric, however *they are not coded by me or George*. Out of the 30 plugins, 29 of them are either coded by George or myself. Out of the mods, 0 out of 3 are coded by George or myself. They are actually coded by 2 separate mod developers, under pay, because *I don't know how to code mods*. I have also mentioned the fact that I don't know how to code mods on many different live streams, and even in a large Q&A. This was around and well before this drama, very consistently. I have also mentioned in private, even to speedrun.com moderators that I don't know how to code mods.

As recently as September 7th, around a month before this incident, I was even *specifically asked* about whether I knew how to code *specifically* fabric mods, by a speedrun moderator in order for them to get my help to develop a speedrun cheat detection client, and I said then that I specifically have no experience coding mods and know nothing about fabric. I had no reason to lie, and I did try and help them on the creative side of things, but not the development due to the fact that I have no experience. All of this is obviously provable. I don't even know what development environment I would code a mod like this in, and I have and will willingly submit to giving up any of my development environment files on any of my devices. I use eclipse for coding plugins, and I've never used anything other than eclipse other than maybe to try something out.

I believe that with all of this information, it makes it very unlikely that I custom coded a fabric mod to modify piglin barterers. Again, extremely unlikely does not mean impossible, but still, extremely unlikely. Now I'm not sure what other methods of cheating there could be, but these are the ones that I've been accused of.

As for further on the how, we also have to talk about *HOW* the cheating took place. Meaning, ignoring the method of injecting cheating, *how did the cheating work if there was cheating*. In this case, the assumption is that piglin barterers were increased from ~5% to ~15%. I'm not extremely well versed in statistics, but even I can say that that would be *extremely dumb*.

Not only is it a very cave man way to cheat, it's also very unlikely given the fact that it's a mod. If someone goes through the effort to cheat using a mod, I'm sure it would take 2 seconds to make it be in a very controllable way. If someone did know how to code mods, they would probably recognize that controlling when piglins drop pearls would be much better than controlling how much they drop pearls. Even a speedrun moderator mentioned that if they were to cheat, *that is how they would do it*. Now in this case, although you can't 100% prove that is the case, you can prove that again, it's extremely unlikely. There is even a time where I trade 1 gold for 1 pearl trade and then quit the game within seconds after.

If I was intentionally cheating and I knew that drop rates were altered, or I was in control of the drop rates myself, *why would I do this*. This also brings into question *behavioral changes*, of which I don't believe there are any, or at least not widespread ones. Throughout my runs I still collect a lot of extra gold, and a lot of the time I do piglin trades while looking for or before finding a fortress. If I knew that I could guaranteed get pearls on piglin trades, *why would I waste time doing it on seeds that I might not find a fortress on*. On top of that, *why would I trade on runs that I knew were essentially dead runs*. That would just make me suspicious for no reason whatsoever. On top of THAT, *why would I give myself a lot of extra pearls on runs when I didn't need them at all?* There is even a run where I got 26 pearls, and I believe it was 5 pearl trades. Why would I need 5 pearl trades? And if I had a mod to modify piglin barter, why didn't I make sure they had sufficient pearls? Traded for 6 or 8 pearls every time? There's a lot of dumb questions here that make the accusation of cheating just seem absurd given the actual affects of the supposed cheating.

So again, that calls into question *how did the cheating take place?* That doesn't disprove any kind of statistics, but it does call into question a belief on whether someone cheated or not. I gave the analogy in the speedrun discord before, but, if someone like Illumina found an 11 eye end portal, but they had already collected all of the pearls and blaze rods needed for a full portal, despite an 11 eye being virtually impossible statistically, would the consensus be that Illumina was a cheater? Of course it wouldn't, because *the why and the how* contradict the data. I believe that although this does not apply to my PB run, it applies to every run before it, especially runs where the run was completely dead and I said screw it lets trade.

The only way any of this would make sense **at all** is if *I didn't have any reason to believe my piglin barter would be luckier than average*.

That's really it for *the how*, and now to move on to statistics, the part that I know the least about.

## The Data

The data presented is as follows: Over the course of my 6 most recent 1.16 streams, my piglin barter over a 263 trade sample were significantly more lucky than usual. I traded for 41 pearl trades, over the 263 sized sample. That is ~15% odds, instead of ~5% odds. The reason this is significant is because of the sample size. You wouldn't expect to see that many pearl trades

over that many trades basically ever. According to people who are actually good at math, it's a 1 in 40 billion chance. Which is obviously absurd if the data is completely correct.

I decided to talk with some independent sources which are decent with statistics to help me understand the data itself. Now, the pearl trade statistics seems to be accurate. The only thing that hurts the data itself, is how the data was collected. Again, the data was collected because of what I said at the beginning of this document. An overly curious viewer who **noticed I got lucky pearl trades** decided to collect the data. This in itself, means that the data was collected *because the data seemed inconsistent*. On top of that, the more pearl trades you get in a row, the more likely that your sample will be smaller, which in a small sample contributes a lot to the validity of the overall data.

Rather than taking a truly random sample, the sample starts when the luck seems off, and the sample ends as soon as I hit a personal best goal of 19 minutes, because that's when I said I would stop streaming (sub 25). Although this can be touted as a "random set of data", it is most definitely not. There are 5 other 1.16 streams that I streamed on twitch that can be rummaged through that are NOT included in the data, and there are also thousands of offline runs that I have done myself that also have data. On top of that, again, the fact that I got very lucky, means that I trade less, which means that the sample size itself will be forcibly smaller. This, all inclusive, is what is called "Sampling bias".

As described by <http://www.scholarpedia.org/>, "In an unbiased sample, differences between the samples taken from a random variable and its true distribution, or differences between the samples of units from a population and the entire population they represent, **should result only from chance.**" and "**If their differences are not only due to chance, then there is a sampling bias.**" According to this, and basically all statistics experts, a biased sample will cause problems in the measure of probability. As a quote, "**any statistics computed from a bias sample has the potential to be consistently erroneous.**" Consistently erroneous data is data that falls outside of what is acceptable and should be rejected.

Although the data may appear to be unbiased due to the fact that it's my most recent specifically 1.16 streams, it isn't. The way it was collected, and the why it was collected makes it significantly biased sampling. The data was collected because the specific sample seemed off, and the data was collected in a very non-random way, with a significant leaning towards more pearls rather than less. Obviously this makes the situation much more complicated, because there's not that much more data to go off of due to the fact that I run almost completely offline. Although still to this day, *I have seen no charts or data collected from my previous 1.16 streams*. This is called cherry picking, as even stated by a Minecraft developer, "**it's actually a logical fallacy - called cherry picking...choosing only the information which supports my claim and ignoring any that doesn't**"

Obviously due to the fact that this is Minecraft, and I'm being accused of cheating, people can just say that "that data doesn't matter because he could have only turned on his cheats recently", but that's making an assumption and is unfair when talking about collecting unbiased data. The

fact is, I got my best and luckiest runs I've ever had while streaming for my PB. I had plenty and plenty of runs, on stream and off, where I traded tons of gold for no pearls. It's just that during this 263 trade sample, I did not.

Again, although this doesn't affect the actual data, only the sample size, there is also another around ~40 gold I believe that was traded, but unaccounted for in the data due to lack of seeing what was traded for. Although we don't know if these trades were pearls or not, the fact of the matter is that IF they were pearls *we would probably know*, and if I hadn't received pearls prior to these final trades, *we would definitely know what they are*. Which violates one of the only rules that is mentioned in binomial distribution. "For identical trials, probability of success must be the same for each trial." In this case, the probability of success is not technically the same for each trial, even though it may seem like it. Because you are more likely to notice and collect pearl trades than you are to notice and collect non pearl trades. The probability of collected success actually varies depending on the situation. Meaning, if you take each time I stop to trade with piglins as a separate data collection point (~21 different times), the gold that is unaccounted for is likely to be not pearls, but it is very unlikely that pearls go unaccounted for. On top of that, one of the other keys to binomial distribution, is that "the outcome of one trial does not affect the outcome of the other". Which in this case, is up for debate whether that is true or not.

If you look at trades as having *3 possible results* which are: PEARL, NOT PEARL, UNKNOWN. And you consider each Piglin trading session a different data collection session, that rule for binomial distribution does not apply. Because if there is a pearl trade, a very unlikely thing, almost all of the rest of the results from that trial (any gold on the ground), is now UNKNOWN. Meaning that the data ends up being distributed like so:

NOT PEARL  
NOT PEARL  
PEARL  
NOT PEARL  
NOT PEARL  
NOT PEARL  
NOT PEARL  
NOT PEARL  
PEARL  
UNKNOWN  
UNKNOWN  
UNKNOWN  
UNKNOWN

You can replicate that over and over with yourself, unless you stay to see all of the trades even after two successful pearl trades. So again, the outcome of a previous trial DOES affect the outcome of the next trial. It would be naive to assume that it doesn't.

It very much affects the sample, which is again where bias sampling is very important. Obviously within the sample set it seems incredibly unlikely (1 in 40 billion), but when you start talking about why the sample itself is a matter of sampling bias, it starts to seem more likely.

If you decide to pool every run submitted to 1.16 random seed glitchless, this may seem like a completely random sample. However, you will almost definitely get much higher pearl trade rates than they should be. Even though you're taking every single run. The bias is applied because of the fact that the reason you're sampling them is that they were good runs submitted to the leaderboards. Now, there is a chance this isn't the case because sometimes people submit very long runs, **but the point is that sampling and how the sample is collected is VERY important.**

On top of all of that, we are talking about Minecraft and Java. Everything is much more complicated than just strictly ~5%. There's glitches, there's things dependent on the world, there's things that can be corrupted, there's operating system issues, and plenty of other things that could again fall under the "probability of success must be the same" caveat of binomial distribution. But again, these things are unlikely, and even more unlikely when talking about something as specific as pearl trades which are necessary for a good run.

## Misuse of data

Now we can assume with sampling bias taken into account, and everything else, that it's still very very unlikely that the pearl trades were this lucky. Just much more likely than 1 in 40 billion. Even if it's 1 in a million, that's still extremely unlikely.

However, **the likelihood of an event occurring is not the likelihood of someone cheating.** Which is where I see a lot of people getting very confused. If the likelihood of an event happening is 1 in a million, that doesn't mean that there is a 99.9999% chance that they were cheating for that event to happen.

This is seen in this example: As writing this, I went into xQC's most recent live stream, and his most recent pearl trades. In this *completely randomly selected sample*, in a 31 OR LESS trade period, xQC got 33 pearls. Which at minimum is 5 pearl trades, and on average would be at least 6. Now if my calculations are correct, using the same binomial distribution method used against me, this has a 0.296479541% chance with 6 pearl trades, a 0.050943885% chance with 7 pearl trades, and a 1.43774716% with 5 pearl trades.

Again, on this random sample, that is very unlikely, but that does not mean that there is a 99.95% chance that xqc cheated. That just means that it has a very small chance of happening.



So a common misconception with the data, is using the inverse of the percentage chance of something happening, as the percentage chance that someone cheated. This is not how the data should be applied. There is most definitely a correlation, however it is *not equivalent*.

## Final Conclusion

The only reason that I'm even taking the time to write up this document, is because I care about the speedrun community. I came in as an outsider, and obviously there's a lot of people that dislike me because of my community, or my stans, or my attitude or whatever else. I'm sure a lot of those people would still even recognize that I've had a positive impact on the community, and that I've tried to contribute in countless ways whether it be promoting top runners, assisting the mod team, or just bringing attention to speedrunning itself. Now, there's some people that even if I am 1000% proven innocent, will still say I'm a cheater, because it fits their narrative.

Regardless of that, my assumption about everything is that it's just a very unlikely occurrence that is much more likely than the data that is being presented makes it seem, due to sampling bias and other factors. I spoke with a Minecraft dev about it for quite a long time, and the dev pretty much came to that same conclusion. I'm sure I'll probably find myself talking to other developers and staffers as well. The sad thing is that I'm definitely not an expert in statistics so it is much harder for me to defend myself than if I was. (american education)

As for what I would suggest the mod team to do, I would suggest that they take stuff like this extremely seriously, and decide to hold offline runs and even online runs to a much higher level of scrutiny. Before all of this, I almost decided to stop running due to the fact that I recognized there is a high likelihood that top runs may be fake or cheated, and that really discouraged me. But I was encouraged when mods caught a few top submitted runs for being fake. (this is provable again with messages with the mod team). I've seen some good progress on the speedrun client, and I'm fully in support of that, and I used to suggest a server all the time. I want speedrunning to be free of cheaters, and I think knowing that it is what makes it enjoyable for people that do run.

That being said, I'm complacent with the mods removing my 1.16 run and me stopping running until a speedrun client is fully fleshed out and developed, as again, I think having trust that top runners are not cheaters is what makes speedrunning enjoyable, and I don't want to take that away from anyone. I already have a successful career, and I have a lot of fun speedrunning myself, and it's upsetting that this has happened in the first place, however, due to the fact that I'm not a math expert I have no real way of proving my innocence through statistics.

This same scenario may have happened before, or may happen in the future hundreds of times, but we probably wouldn't ever see it because it's not "dream speedrunning" and they don't have hundreds of thousands of eyes on them. I honestly don't care at all about 1.16, I never thought I would get the time I got, and I only wanted to get a single run to submit to the 1.16 leaderboard before I tried what I was actually passionate about, which is 1.14/15.

I've been left a little in the dark when it comes to the process behind the scenes, but I haven't really heard anything good come from the mods, (and some of them definitely don't like me at all), so I'm not really expecting anything good to be announced in my favor. I decided to write this instead of making a video, because even though it will probably be spread a little bit, it's not going to be seen by millions of people who could then bring hate towards the people who are leveling these accusations, as I believe that *most of them* have good intentions (even though I know that some of them definitely don't.). However, depending on how annoying things get, I may be forced to make a video going over things I said here, and a lot of other things. Time will tell with that though.

That's really all there is to say I guess, and that's my perspective.